Amendments to the Claims:

Please amend claims 5 and 15 as follows. This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Original) A device for binarizing an image, comprising:

an input part for receiving an image;

a block classification part for dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

an edge enhancement part for enhancing edges of a character block using relations between neighboring pixels in the character block classified by the block classification part, and generating a threshold for distinguishing character pixels and background pixels of the character block; and

a binarization part for binarizing pixels of character blocks output from the edge enhancement part into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels of the character blocks with the threshold, and binarizing pixels of background blocks output from the block classification part into the second brightness value.

2. (Original) The device of claim 1, wherein the edge enhancement part comprises:

a first threshold selection part for calculating a first threshold for classifying each pixel of the character block as a character pixel or a background pixel;

a mean computation part for classifying pixels of the character block into character pixels and background pixels on the basis of the first threshold, and calculating mean brightness values for character pixels and background pixels of the character block;

a normalization part for normalizing the pixels of the character block using the mean brightness value for character pixels and the mean brightness value for background pixels

output from the mean computation part so that the character pixels have a value close to '1' while the background pixels have a value close to '0';

a quadratic operation part for performing a quadratic operation on the normalized character block to enhance edges of the character block and reduce noise of the character block;

a denormalization part for denormalizing the quadratic-processed character block and providing the denormalized character block to the binarization part; and

a second threshold selection part for calculating a second threshold for classifying each pixel of the denormalized character block as a character pixel or a background pixel, and outputting the second threshold as a threshold for the binarization part.

3. (Original) The device of claim 2, wherein the edge enhancement part is a quadratic filter.

4. (Original) The device of claim 1, wherein the block classification part comprises:

an image division part for dividing the received image into blocks having a predetermined size;

a discrete cosine transform (DCT) conversion part for DCT-converting blocks output from the image division part;

an energy calculation part for calculating a sum of absolute values of dominant DCT coefficients within each of the DCT-converted blocks, and outputting the calculated sum as an energy value of the corresponding block;

a threshold calculation part for summing up the energy values calculated for respective blocks by the energy calculation part, and generating a threshold by dividing the summed energy value by the total number of blocks; and

a classification part for sequentially receiving the energy values for the respective blocks from the energy calculation part, and classifying corresponding blocks as character blocks or background blocks by comparing the received energy values with the threshold.

5. (Currently Amended) The device of claim 4, wherein each of the blocks has a size of 8×8 pixels, and an energy value of each block is calculated by <u>an equation</u>:

$$S^k = \sum_{i=1}^{9} \left| D_i^k \right|$$

where $\left| D_i^k \right|$ denotes an ith dominant DCT coefficient of a kth block, and S^k denotes a sum of absolute values of dominant DCT coefficients in the kth block.

6. (Original) The device of claim 1, wherein the edge enhancement part comprises:

a first threshold selection part for calculating a first threshold for classifying each pixel of the character block as a character pixel or a background pixel;

a mean computation part for classifying pixels of the character block into character pixels and background pixels on the basis of the first threshold, and calculating mean brightness values for character pixels and background pixels of the character block;

a normalization part for normalizing pixels of the character block using the mean brightness value for character pixels and the mean brightness value for background pixels output from the mean computation part so that the character pixels have a value close to '1' while the background pixels have a value close to '0';

a quadratic operation part for performing a quadratic operation on the normalized character block so as to enhance edges of the character block and reduce noise of the character block; and

a second threshold selection part for calculating a second threshold for classifying pixels into character pixels and background pixels, by normalizing the first threshold, and outputting the second threshold as a threshold for the binarization part.

7. (Original) A device for binarizing an image, comprising:

an input part for receiving an image;

a block classification part for dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

a block growing part for growing the classified character blocks, and restoring a block containing a character pixel, classified as a background block, to a character block;

an edge enhancement part for enhancing edges of a character block using relations between neighboring pixels in the character block output from the block growing part, and generating a threshold for distinguishing character pixels and background pixels of the character block; and

a binarization part for binarizing pixels of character blocks output from the edge enhancement part into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels of the character blocks with the threshold, and binarizing pixels of background blocks output from the block growing part into the second brightness value.

8. (Original) The device of claim 7, wherein the block growing part comprises:

a dilation part for growing a character block and changing a block containing a character pixel, classified as a background block, to a character block; and

a closing part for eroding the dilated character block and deducting connected blocks.

9. (Original) A device for binarizing an image, comprising:

an input part for receiving an image;

a block classification part for dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

a block grouping part for grouping a character block classified by the block classification part with its neighboring blocks, thereby generating a grouped block;

an edge enhancement part for enhancing edges of the character block using relations between neighboring pixels in the grouped block, and generating a threshold for distinguishing character pixels and background pixels of the character block;

a block splitting part for separating the character block from the grouped block output from the edge enhancement part; and

a binarization part for binarizing pixels of the separated character block into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels of the separated character block with the threshold, and binarizing pixels of the background block output from the block classification part into the second brightness value.

10. (Original) A device for binarizing an image, comprising:

an input part for receiving an image;

a block classification part for dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

a block growing part for growing the classified character block, and restoring a block containing a character pixel, classified as a background block, to a character block;

a block grouping part for grouping a character block output from the block growing part with its neighboring blocks, thereby generating a grouped block;

an edge enhancement part for enhancing edges of the character block using relations between pixels in the grouped block, and generating a threshold for distinguishing character pixels and background pixels of the character block;

a block splitting part for separating the character block from the grouped block output from the edge enhancement part; and

a binarization part for binarizing pixels of the separated character blocks into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels of the separated character blocks with the threshold, and binarizing pixels of a background block output from the block growing part into the second brightness value.

11. (Original) A method for binarizing an image, comprising the steps of:

receiving an image;

dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

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enhancing edges of a character block using relations between neighboring pixels in the character block, and generating a threshold for distinguishing character pixels and background pixels of the character block; and

binarizing pixels of the edge-enhanced character blocks into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels of the character blocks with the threshold, and binarizing pixels of the classified background blocks into the second brightness value.

12. (Original) The method of claim 11, wherein the edge enhancement step comprises the steps of:

calculating a first threshold for classifying each pixel of the character block as a character pixel or a background pixel;

classifying pixels of the character block into character pixels and background pixels on the basis of the first threshold, and calculating mean brightness values for character pixels and background pixels of the character block;

normalizing the pixels of the character block using the mean brightness value for character pixels and the mean brightness value for background pixels so that the character pixels have a value close to '1' while the background pixels have a value close to '0';

performing a quadratic operation on the normalized character block to enhance edges of the character block and reduce noises of the character block;

denormalizing the quadratic-processed character block so that the denormalized character block can be processed in a binarization step; and

calculating a second threshold for classifying each pixel of the denormalized character block as a character pixel or a background pixel, and outputting the second threshold as a threshold for the binarization step.

13. (Original) The method of claim 12, wherein the edge enhancement is performed by a quadratic filter.

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14. (Original) The method of claim 11, wherein the block classification step comprises the step of:

dividing the received image into blocks having a predetermined size;

discrete cosine transform (DCT) -converting the divided blocks;

calculating a sum of absolute values of dominant DCT coefficients within each of the DCT-converted blocks, and outputting the calculated sum as an energy value of the corresponding block;

summing up the energy values calculated for respective blocks, and generating a threshold by dividing the summed energy value by the total number of blocks; and

sequentially receiving the energy values for the respective blocks, and classifying corresponding blocks as character blocks or background blocks by comparing the received energy values with the threshold.

15. (Currently Amended) The method of claim 14, wherein each of the blocks has a size of 8×8 pixels, and an energy value of each block is calculated by an equation:

$$S^k = \sum_{i=1}^{9} \left| D_i^k \right|$$

where $\left| D_i^k \right|$ denotes an ith dominant DCT coefficient of a kth block, and S^k denotes a sum of absolute values of dominant DCT coefficients in the kth block.

16. (Original) The method of claim 11, wherein the edge enhancement step comprises the steps of:

calculating a first threshold for classifying each pixel of the character block as a character pixel or a background pixel;

classifying pixels of the character block into character pixels and background pixels on the basis of the first threshold, and calculating mean brightness values for character pixels and background pixels of the character block;

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normalizing pixels of the character block using the mean brightness value for character pixels and the mean brightness value for background pixels so that the character pixels have a value close to '1' while the background pixels have a value close to '0';

performing a quadratic operation on the normalized character block so as to enhance edges of the character block and reduce noise of the character block; and

calculating a second threshold for classifying pixels into character pixels and background pixels, by normalizing the first threshold, and outputting the second threshold as a threshold for the binarization step.

17. (Original) A method for binarizing an image, comprising the steps of:

receiving an image;

dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

growing the classified character blocks, and restoring a block containing a character pixel, classified as a background block, to a character block;

enhancing edges of a character block using relations between neighboring pixels in the character block, and generating a threshold for distinguishing character pixels and background pixels of the character block; and

binarizing pixels of the edge-enhanced character blocks into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels of the character blocks with the threshold, and binarizing pixels of the background blocks into the second brightness value.

18. (Original) The method of claim 17, wherein the block growing step comprises the steps of:

growing a character block and changing a block containing a character pixel, classified as a background block, to a character block; and

eroding the dilated character block and deducting connected blocks.

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19. (Original) A method for binarizing an image, comprising the steps of:

receiving an image;

dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

grouping the classified character block with its neighboring blocks, thereby generating a grouped block;

enhancing edges of the character block using relations between neighboring pixels in the grouped block, and generating a threshold for distinguishing character pixels and background pixels of the character block;

separating the character block from the edge-enhanced grouped block; and

binarizing pixels of the separated character block into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels of the separated character block with the threshold, and binarizing pixels of the background block into the second brightness value.

20. (Original) A method for binarizing an image, comprising the steps of:

receiving an image;

dividing the received image into blocks, and classifying the divided blocks into character blocks and background blocks;

growing the classified character block, and restoring a block containing a character pixel, classified as a background block, to a character block;

grouping the character block with its neighboring blocks, thereby generating a grouped block;

enhancing edges of the character block using relations between pixels in the grouped block, and generating a threshold for distinguishing character pixels and background pixels of the character block;

separating the character block from the grouped block; and

binarizing pixels of the separated character blocks into a first brightness value for character pixels and a second brightness value for background pixels by comparing the pixels

of the separated character blocks with the threshold, and binarizing pixels of the background

blocks into the second brightness value.